MULTIMEDIA ⬤ UNIVERSITY

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 1, 2019/2020

TAI2151 – ARTIFICIAL INTELLIGENCE FUNDAMENTALS
(All Sections/Groups)

24 OCTOBER 2019
9.00am – 11.00am
(2 Hours)

INSTRUCTIONS TO STUDENT

1. This question paper consists of **5** pages with **5** questions only.
2. Attempt **ALL FIVE** questions. All questions carry equal marks and the distribution of the marks for each question is given.
3. Please write all your answers in the answer booklet provided.

Question 1

(a) Describe briefly The Turing Test.   (1 mark)

(b) Give one argument for and one argument against The Turing Test being a good test for measuring Intelligence.   (2 marks)

(c) This question is about the game of tic-tac-toe as shown below. It is played on a board of 9 squares, divided into 3 rows and 3 columns. Starting with an empty board, the players in alternating turns place a single piece in an empty square. The starting player places X's, and the other player places O's. The first player to line up 3 of their pieces in a line (horizontal, vertical, or diagonal), wins the game. If no more moves are possible the game ends in a draw.


(i) Give the PEAS (Performance Environment Actuator Sensor) description for the starting/first player in tic-tac-toe.   (2 marks)

(ii) Classify with justification, the tic-tac-toe task environment according to the following properties:

|	
Fully observable/partially observable	(1 mark)
Deterministic/stochastic	(1 mark)
Episodic/sequential	(1 mark)
Static/dynamic/semi-dynamic	(1 mark)
Discrete/continuous	(1 mark)

Continued....

Question 2
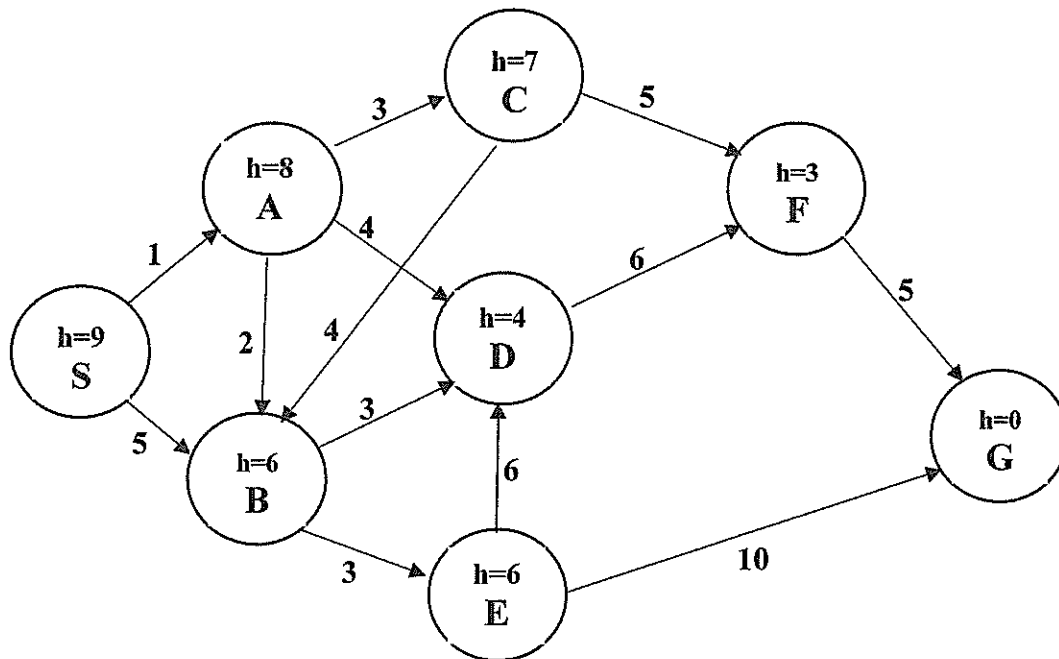
In this problem the start state is *S*, and the goal state is *G*. The transition costs are next to the edges, and the heuristic estimate, *h*, of the distance from the state to the goal is in the state's node. Assume ties are always broken by choosing the state which comes first alphabetically.

(a) What is the order of states expanded using Depth First Search? Assume Depth First Search terminates as soon as it reaches the goal state.   (2 marks)

(b) What is the order of states expanded using Breadth First Search?   (2 marks)

(c) What is the order of states expanded using Greedy Search? Assume Greedy Search terminates as soon as it reaches the goal state.   (2 marks)

(d) What is the order of states expanded using A* search?   (2 marks)

(e) What is the least cost path from S to G?   (2 marks)

Continued....

Question 3

Consider the game tree picture below where nodes A to F represent some real values. Assume the nodes are explored from left to right and standard alpha beta pruning is used.
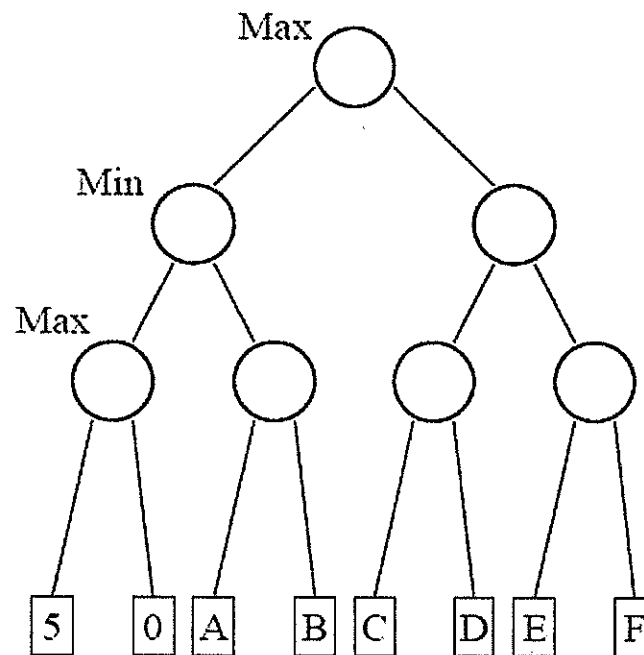
(a)   Give a value of A such that B is pruned.   (2 marks)

(b)   Give a value of A such that B is not pruned.   (2 marks)

(c)   True or False: There are some values of A and B such that the subtree containing C and D is pruned.   (2 marks)

(d)   Assuming that $B = 5$ and $A = 5$, give a value of C and D such that the subtree containing E and F is pruned.   (2 marks)

(e)   If you are allowed to assign A to F arbitrarily, what is the maximum number of leaves that can be pruned?   (2 marks)

Continued....

Question 4

You are given the following predicates:

$common\_sense(X)$ = X has common sense
$intelligent(X)$ = X is intelligent
$useful(X)$ = X is useful

(a) Translate the following English sentences into First-Order Logic statements:
   1. Robot has common sense.
   2. If something has common sense, it is intelligent.
   3. All intelligent things are useful.   (2 marks)

(b) Convert the First-Order Logic statements obtained in (a) into Conjunctive Normal Form.
                                                                            (2 marks)

(c) Following from (a) and (b) above, prove that Robot is useful using resolution refutation.
                                                                            (6 marks)

Continued....

Question 5

We will use the dataset below to learn a decision tree which predicts if people pass machine learning (True or False), based on their previous GPA (High, Medium, or Low) and whether or not they studied (True or False).

GPA	Studied	Passed
L	F	F
L	T	T
M	F	F
M	T	T
H	F	T
H	T	T

For your information, $log_2 1 = 0$, $log_2 2 = 1$, $log_2 3 = 1.6$, $log_2 4 = 2$, $log_2 5 = 2.3$
Also, $log(x/y) = log\ x - log\ y$

(a) What is the entropy H(Passed)?   (2 marks)

(b) What is the entropy H(Passed | GPA)?   (2 marks)

(c) What is the entropy H(Passed | Studied)?   (2 marks)

(d) Draw the full decision tree that would be learned for this dataset. Give a brief explanation.   (4 marks)

End of Paper